

WHAT IS CLAIMED IS:

- [c1] A permanent magnet assembly comprising a fixed permanent magnet body and a movable permanent magnet body which is movable relative to the fixed permanent magnet body.
- [c2] The assembly of claim 1, wherein:
 - the fixed permanent magnet body is fixed to a support; and
 - the movable permanent magnet body is movable relative to the fixed permanent magnet body during a B_o field adjustment of the assembly and is adapted not to move relative to the fixed permanent magnet body while the assembly is in operation.
- [c3] The assembly of claim 2, wherein the movable permanent magnet body is located between the fixed permanent body and the support.
- [c4] The assembly of claim 1, wherein the movable permanent magnet body comprises removable permanent magnet pieces located in an opening in the assembly and which are adapted to be added or removed from the assembly to adjust a B_o field of the assembly.
- [c5] The assembly of claim 4, wherein the opening extends partially into the fixed permanent magnet body and the permanent magnet pieces are located at least partially in a portion of the opening which extends into the fixed permanent magnet body.
- [c6] The assembly of claim 4, wherein the permanent magnet pieces have a positive magnetization with respect to the magnetization of the fixed permanent magnet body.
- [c7] The assembly of claim 4, wherein the permanent magnet pieces have a negative magnetization with respect to the magnetization of the fixed permanent magnet body.

[c8] The assembly of claim 1, wherein the movable permanent magnet body comprises a movable permanent magnet plug which is moved relative to the fixed permanent magnet body by an actuator.

[c9] The assembly of claim 8, wherein the permanent magnet plug is located in an opening which extends partially into the fixed permanent magnet body and the permanent magnet plug is located at least partially in a portion of the opening which extends into the fixed permanent magnet body.

[c10] The assembly of claim 9, further comprising a metal backing located between the actuator and the permanent metal plug.

[c11] The assembly of claim 2, wherein the assembly is located in an imaging system.

[c12] The assembly of claim 11, wherein:

the support comprises a yoke of the imaging system and the movable permanent magnet body is located between a back side of the fixed permanent magnet body and the yoke.

the fixed permanent magnet body comprises first surface and a stepped second surface which is adapted to face an imaging volume of the imaging apparatus;

the stepped second surface contains at least four steps;

at least one layer of soft magnetic material is attached to the first surface of the fixed permanent magnet body, such that movable permanent magnet body is movable in an opening located in the at least one layer of soft magnetic material;

the at least one layer of soft magnetic material is attached the yoke;

the fixed permanent magnet body comprises a cylindrical base section having a major first surface attached to the at least one layer of a soft magnetic material and a major second surface having at least three steps, and a hollow ring section attached to an outer portion of second surface of the base section;

the ring section extends at least 0.05 meters above an outer step on the second surface of the base section to form a pocket; and
the pocket is filled with metal shims.

[c13] The assembly of claim 1, wherein the assembly is located in a motor or in a generator.

[c14] A magnetic imaging apparatus, comprising:
a yoke comprising a first portion, a second portion and at least one third portion connecting the first and the second portions such that an imaging volume is formed between the first and the second portions; and
a first permanent magnet assembly attached to the first yoke portion, wherein the permanent magnet assembly comprises a fixed permanent magnet body and a movable permanent magnet body which is movable relative to the fixed permanent magnet body.

[c15] The apparatus of claim 14, wherein:
the fixed permanent magnet body is fixed to the first portion of the yoke; and
the movable permanent magnet body is movable relative to the fixed permanent magnet body during a B_0 field adjustment of the first assembly and is adapted not to move relative to the fixed permanent magnet body while the apparatus is in operation.

[c16] The apparatus of claim 15, wherein:
the fixed permanent magnet body comprises a first surface and a second surface which is adapted to face an imaging volume of the imaging apparatus; and
the movable permanent magnet body is located between the first surface of the fixed permanent body and the first portion of the yoke.

[c17] The apparatus of claim 16, further comprising:
at least one layer of soft magnetic material attached to the first surface of the fixed permanent magnet body; and

a first opening which extends through the at least one layer of soft magnetic material and through the first portion of the yoke, wherein the movable permanent magnet body is located in the first opening.

[c18] The apparatus of claim 17, wherein the first opening extends partially into the fixed permanent magnet body and the movable permanent magnet body is located at least partially in a portion of the first opening which extends into the fixed permanent magnet body.

[c19] The apparatus of claim 16, wherein the movable permanent magnet body comprises removable permanent magnet pieces which are adapted to be added or removed from the first assembly to adjust the B_o field of the first assembly.

[c20] The apparatus of claim 18, wherein the permanent magnet pieces have a positive magnetization with respect to the magnetization of the fixed permanent magnet body.

[c21] The apparatus of claim 18, wherein the permanent magnet pieces have a negative magnetization with respect to the magnetization of the fixed permanent magnet body.

[c22] The apparatus of claim 16, wherein the movable permanent magnet body comprises a movable permanent magnet plug which is moved relative to the fixed permanent magnet body by an actuator.

[c23] The apparatus of claim 22, further comprising a metal backing located between the actuator and the permanent metal plug.

[c24] The apparatus of claim 14, further comprising:
a second permanent magnet assembly attached to the second yoke portion,
wherein the second permanent magnet assembly comprises a fixed permanent magnet

body and a movable permanent magnet body which is movable relative to the fixed permanent magnet body.

[c25] The apparatus of claim 17, wherein:

the fixed permanent magnet body comprises a permanent magnet RMB material, where R comprises at least one rare earth element and M comprises at least one transition metal;

the permanent magnet RMB material comprises 13-19 atomic percent R, 4-20 atomic percent B and the balance M, where R comprises 50 atomic percent or greater Pr, 0.1-10 atomic percent of at least one of Ce, Y and La, and the balance Nd, and M comprises Fe;

the at least one layer of a soft magnetic material comprises a laminate of Fe-Si, Fe-Al, Fe-Co, Fe-Ni, Fe-Al-Si, Fe-Co-V, Fe-Cr-Ni or amorphous Fe- or Co-base alloy layers;

the at least one layer of soft magnetic material is attached the yoke;

the second surface of the fixed permanent magnet body contains at least four steps;

the fixed permanent magnet body is larger than the movable permanent magnet body;

the fixed permanent magnet body comprises a cylindrical base section having a major first surface attached to the at least one layer of a soft magnetic material and a major second surface having at least three steps, and a hollow ring section attached to an outer portion of second surface of the base section;

the ring section extends at least 0.05 meters above an outer step on the second surface of the base section to form a pocket; and

the pocket is filled with metal shims.

[c26] A permanent magnet assembly, comprising:

a fixed permanent magnet body; and

a first permanent magnet means for moving relative to the fixed permanent magnet body to adjust a B_o field of the assembly.

[c27] The assembly of claim 26, wherein:

the fixed permanent magnet body is fixed to a support; and

the first permanent magnet means moves relative to the fixed permanent magnet body during a B_0 field adjustment of the assembly and does not move relative to the fixed permanent magnet body while the assembly is in operation.

[c28] The assembly of claim 26, wherein the first permanent magnet means is moved relative to the fixed permanent magnet body by being added or removed from the assembly to adjust the B_0 field of the assembly.

[c28] The assembly of claim 28, wherein the first permanent magnet means is moved relative to the fixed permanent magnet body by being moved toward or away from the fixed permanent magnet body to adjust the B_0 field of the assembly.

[c29] The assembly of claim 27, wherein:

the assembly is located in an imaging system;

the support comprises a yoke of the imaging system; and

the first permanent magnet means is located between a back side of the fixed permanent magnet body and the yoke.

[c30] The assembly of claim 26, wherein the assembly is located in a motor or in a generator.

[c31] A method of making a permanent magnet assembly, comprising:

providing a fixed permanent magnet body;

providing a movable permanent magnet body; and

moving the movable permanent magnet body relative to the fixed permanent magnet body to adjust a B_0 field of the assembly.

[c32] The method of claim 31, wherein:

the fixed permanent magnet body is fixed to a support; and

the movable permanent magnet body moves relative to the fixed permanent magnet body during the B_o field adjustment of the assembly and does not move relative to the fixed permanent magnet body while the assembly is in operation.

[c33] The method of claim 31, wherein the step of moving the movable permanent magnet body comprises adding or removing removable permanent magnet pieces to and from an opening located in the assembly.

[c34] The method of claim 33, wherein the removable permanent magnet pieces are provided into the opening which extends partially into the fixed permanent magnet body, such that the permanent magnet pieces are located at least partially in a portion of the opening which extends into the fixed permanent magnet body.

[c35] The method of claim 33, wherein the permanent magnet pieces have a positive or a negative magnetization with respect to the magnetization of the fixed permanent magnet body.

[c36] The method of claim 33, further comprising adding or removing a metal backing material to and from the assembly to keep a metal volume of the assembly constant irrespective of a number of permanent magnet pieces added to or removed from the assembly.

[c37] The method of claim 31, wherein the step of moving the movable permanent magnet body comprises using an actuator to move a movable permanent magnet plug relative to the fixed permanent magnet body.

[c38] The method of claim 37, wherein the permanent magnet plug is located in an opening which extends partially into the fixed permanent magnet body and the permanent magnet plug is located at least partially in a portion of the opening which extends into the fixed permanent magnet body.

[c39] The method of claim 37, wherein the movable permanent magnet plug and the fixed permanent magnet body are magnetized after the movable permanent magnet plug and the fixed permanent magnet body are attached to a support of an imaging system.

[c40] The method of claim 32, wherein:

the assembly is located in an imaging system;

the support comprises a yoke of the imaging system; and

the movable permanent magnet body is moved in an opening in the yoke which extends at least to a back side of the fixed permanent magnet body.

[c41] The method of claim 31, wherein the assembly is located in a motor or in a generator.

[c42] The method of claim 31, further comprising attaching at least one layer of a soft magnetic material to the fixed permanent magnet body such that the movable permanent magnet body is located in an opening in the at least one layer of a soft magnetic material.

[c43] The method of claim 31, further comprising:

designing the fixed permanent magnet body and the shim dimensions at the same time; and

forming the fixed permanent magnet body and shimming the permanent magnet assembly based on the design.

[c44] The method of claim 31, wherein the B_0 field adjustment is performed in conjunction with shimming the permanent magnet assembly.

[c45] The method of claim 31, wherein the fixed permanent magnet body is larger than the movable permanent magnet body.